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DEVICE FOR THE PRODUCTION OF AEROSOLS

Description

The invention relates to a device for the production of aerosols for therapeutic treatments with several containers each for a treatment liquid, to each of which containers there is assigned a jet nebuliser driven by a gaseous medium, the said containers being connected to a mist collection channel either directly or via a mist chamber.

A device of the said type is known from German Patent specification 39 08 909. The specification provides for several containers, which are secured to a container support. Various medications in liquid form are introduced into these containers. Depending on therapeutic need, a very fine mist is produced from the liquid of optionally one or more of the containers by means of a jet nebuliser. This is achieved by compressed air from a source of compressed air being passed in a pipe to the jet nebuliser which has a nebuliser jet that via a connection piece dips into the liquid and past which the compressed air is fed at a relatively high flow rate. By means of the resultant Venturi effect the liquid is atomised to a very fine mist.

The pressure of the introduced air is reduced very greatly by volume expansion in the container and approaches ambient atmospheric pressure. By means of a displacement effect the volume of the mist produced causes dispersion of the mist into a mist chamber and an adjoining mist collection chamber. The mist collection chamber is connected to an inhalation hose provided with a mouthpiece through which a patient can breath and thereby inhale the active ingredient mist.

However, since the mist disseminates not only in the direction of the mist collection chamber but also enters into the interior of the containers that are not active during the procedure because, for example, the active ingredient located therein is not used in the patient, the result can be contamination of the active ingredient located therein.

An attempt is made in the said patent specification to avoid this disadvantage by the mist collection channel not being located directly above the openings of the containers. The effect of this is that larger mist droplets drip back into the container from which they originate and hence major contamination of other containers is avoided. Contamination by finer mist parts cannot be ruled out, however, as the mist penetrates the interior of those containers where no nebulisation takes place, which therefore are inactive.

The problem of the present invention is therefore to prevent contamination of the active ingredients in the containers that are inactive whilst the device is being used.

In accordance with the invention this problem is solved by media being provided between the containers and the mist collection channel which prevent a mist from flowing into non-active containers.

A particularly favourable embodiment of the invention provides for externally activatable seals being located between the connection side of the containers and the mist collection channel. These seals cover at least the opening of the containers to the mist collection channel or block the mist chamber to the mist collection channel.

Secure separation is of course guaranteed by ensuring a hermetically tight closure of the container. However, since the mist spreads on the basis of the displacement principle, a very effective and inexpensive solution to the problem is achieved with a covering.

A mechanical seal of this nature can be achieved with a stopper, valve or flap.

A particularly favourable embodiment of the invention provides for the interior space of a container to be connected via a regulating device to a compressed air or inert gas source.

Air can thereby flow into the interior space of the container, said air preventing penetration of mist and hence contamination.

Generally, normal ambient air is sufficient for avoiding contamination. However, since air is a mixture of gases from which contamination can emanate in some applications, it is therefore expedient to use inert gases for apply pressure to the interior of the containers.

It is particularly expedient, for connecting the containers to a compressed gas source, to provide for a pressure distributor which can be connected to the compressed air source serving to apply pressure on the jet nebulisers.

Auxiliary pipes in contact with the interior of the containers are connected to this pressure distributor via throttle valves, serving as regulating devices.

These throttle valves serve to adjust the pressure additionally applied to the containers. Thus a pressure is set in the interior of the container which is greater than the ambient atmospheric pressure by such a minimal amount that a barely perceptible flow of air occurs from the interior of the container to the mist collection channel.

It is particularly expedient to connect the auxiliary pipes with the interior of the containers via the jet nebulisers. This is done in such a way that the auxiliary pipes are integrated into pipes serving to apply pressure on the jet nebulisers.

The additional flow of air or inert gas into the interior of the containers can take place continuously. It is expedient, however, to provide this only for the time during which there is mist production. It is also favourable to position an electromagnetic valve connected to an electric time switch between the compressed air source and the pressure distributor.

Since devices of the said type are known to be controlled by a time switch, contemporaneous control can be achieved by connecting the electromagnetic valve to this time switch.

There is also the possibility of locating electromagnetic valves connected to an electric time switch in the auxiliary pipes. This too enables contemporaneous control. In addition, each auxiliary pipe can be electrically controlled individually.

A further favourable embodiment of the invention provides for the regulating device being part of a control loop. This control loop has a set-point transmitter which is designed as a first pressure sensor and which, in the mist collection channel, is located in an inhalation pipe connected to the mist collection channel or on the exterior of the device.

A second pressure sensor is provided in the control loop as a measuring device for measuring the controlled variable and is located in the interior of the container or in the mist chamber.

This design offers the advantage that an optimal pressure is always produced in the auxiliary pipes and the possibility of operating errors is ruled out.

The invention will be explained in greater detail below on the basis of an embodiment. The accompanying drawing shows a schematic cross-section through a device according to the invention.

The embodiment provides for five containers **1** in which there are different active ingredients **2**. Into these active ingredients **2** there dip jet nebulisers **3** which are connected via pipes **4** to a pressure distributor **5**. Together with the compressor **6** this pressure distributor **5** constitutes a compressed air source, the air being cleaned via a filter **7**.

To control the individual jet nebulisers **3** electromagnetic valves **8** are located along the pipes **4** which can be controlled via push-button switches **9**.

Mist production can therefore optionally be switched on in the containers **1** by simple activation of the push-button switches **9**.

The mist produced enters a mist collection channel **11** via mist chambers **10** and from there reaches the patient via an inhalation tube **13**.

The mist chambers **10** are located in a container support **14** to which the containers **1** are secured with their opening uppermost.

A pressure distributor **16** is connected to the pressure distributor **5** via an electromagnetic valve **15**. From the pressure distributor **16** there emanate five auxiliary pipes **17** each of which is integrated into a pipe **4** via throttle valves **18**.

A pressure is set on the throttle valves **18** which is so minimal that it does not cause any mist production in the jet nebulisers **3** but is sufficient to produce a weak flow of air in the containers **1** and the mist chambers **10**. This flow of air is then sufficient to

prevent penetration of mist from other containers **1** if the container **1** in question is not active, in other words the jet nebuliser is not supplied with compressed air via the pipe **4**. Thus, reciprocal contamination of the active ingredients **2** can be effectively prevented.

For the purposes of control, an electric time switch **19** is provided in the device, the output of which serves to control the electromagnetic valve **15**. It can thus be achieved that in the pressure distributor **16** compressed air is only provided from the pressure distributor **5** when the device is in operation.

List of reference numbers

1 Container
2 Active ingredient
3 Jet nebuliser
4 Pipe
5 Pressure distributor
6 Compressor
7 Filter
8 Electromagnetic valve
9 Push-button switch
10 Mist chamber
11 Mist collection channel
12 Re-breathing valve
13 Inhalation tube
14 Container support
15 Electromagnetic valve
16 Pressure distributor
17 Auxiliary pipe
18 Throttle valve
19 Electric time switch

Claims

1. Device for the production of aerosols for therapeutic treatments with several containers **(1)** each for a treatment liquid, to each of which containers there is assigned a jet nebuliser driven by a gaseous medium, the said containers being connected to a mist collection channel either directly or via a mist chamber, characterised in that media are provided between the containers **(1)** and the mist collection channel **(11)** which prevent a mist from flowing into non-active containers **(1)**.

2. Device for aerosol production for therapeutic treatments according to claim 1, characterised in that between the connection side of the containers **(1)** and the mist collection channel **(11)** there are located externally activatable seals which at least cover the opening of the containers **(1)** to the mist collection channel **(11)** or block the mist chamber **(10)** to the mist collection channel **(11)**.

3. Device for aerosol production for therapeutic treatments according to claim 1, characterised in that the interior of a container (**1**) is connected via a regulating device (**18**) to a compressed air or inert gas source (**5, 6**).

4. Device for aerosol production for therapeutic treatments according to claim 3, characterised in that a pressure distributor (**16**) is connected to the compressed air source (**5, 6**) serving for application of pressure, to which source auxiliary pipes (**17**) are connected via throttle valves (**18**) acting as regulating devices, said auxiliary pipes being in contact with the interior of the containers (**1**).

5. Device for aerosol production for therapeutic treatments according to claim 4, characterised in that the auxiliary pipes (**17**) are connected with the interior of the containers (**1**) via the jet nebulisers (**3**) in such a way that the auxiliary pipes (**17**) are integrated into pipes (**4**) serving to apply pressure on the jet nebulisers (**3**).

6. Device for aerosol production for therapeutic treatments according to claim 4 or 5, characterised in that an electromagnetic valve (**15**) connected to an electric time switch (**19**) is located between the compressed air source (**5, 6**) and the pressure distributor (**16**).

7. Device for aerosol production for therapeutic treatments according to claim 4 or 5, characterised in that electromagnetic valves connected to an electric time switch (**19**) are located in the auxiliary pipes (**17**).

8. Device for aerosol production for therapeutic treatments according to any one of claims 3 to 7, characterised in that the regulating device is part of a control loop which has a first pressure sensor as a set-point transmitter, which in the mist collection channel (**11**) is located in an inhalation tube (**13**) connected to the mist collection channel (**11**) or on the exterior of the device and which has a second pressure sensor as a measuring device for measuring the controlled variable and is located in the interior of the container (**1**) or in the mist chamber (**10**).

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